REMARKS

Claims 1- 7 were before the Office. In the Office Action of September 24, 2001, the drawings were objected to, the specification was objected to, the abstract was cited for being too long, claims were objected to, claims were rejected under 35 §'s 112 and 103 and Claim 1 was rejected under the judicially created doctrine of obviousness-type double patenting. Applicant herewith submits amended drawings, amends the specification, abstract and claims, and submits a terminal disclaimer. Claims 1-7 are before the Office.

Corrected Drawings of Figures 1 and 2 change old reference number "11a" to reference number "16". The specification has been modified to refer to reference number "5a".

An abstract of the proper length is herewith submitted.

The specification has been amended to remove the objected to informalities.

The claims have been amended to remove the informalities.

Claims 1 has been amended to provide antecedent basis, remove the reference to "plurality of stripes", and to positively claim the invention.

Claim 3 has been amended to improve antecedent basis.

Claim 4 has been amended to improve antecedent basis and definiteness and positively claim the invention.

Claim 6 and 7 has been amended to positively claim the invention.

A Terminal Disclaimer in compliance with 37 CFR 1.321(c) accompanies this response to overcome the provisional rejection under the judicially created doctrine of obviousness-type double patenting. A certificate under 37 CFR § 3.73 is not currently available but will be forthcoming.

Claims 1-7 were rejected under 35 USC §103(a) over Bradley et al. US Patent No. 5,040,589 in view of Kono US Patent No. 5,982,976 and further in view of Kono US Patent No. 5,836,372. Applicant traverses the rejection.

Amended Claim 1 recites an injection molding machine for low-melting point metallic material in which the injection molding machine is constituted by an injection mechanism having a tip portion, a melting cylinder, and a rear-end portion. The tip portion having a weighing chamber with a required length communicating with a nozzle member at a first end and with the melting cylinder at a second end. The melting cylinder having a supply port on an upper side and an agitating and injection means disposed within. The melting cylinder provided obliquely in a manner that a tip portion end is directed in a downward direction so that a molten metal in said melting cylinder flows down by self-weight to be stored in the tip portion. The said agitating

and injection means is adapted to rotate or advance or retreat freely. The rear-end portion is aligned with and spaced behind an upward end of the melting cylinder and includes a device for driving those agitating and injection means. The injection molding machine further includes a mold-clamping mechanism disposed external to and downward from the nozzle member of the tip portion. An implementation of the agitating and injection means is constituted by an agitating member in which a plurality of agitating wings are formed intermittently about an outer periphery of a tip portion of a hollow shaft that extends a length of the melting cylinder. The agitating wings have an external diameter approximately equal to an inner diameter of the melting cylinder. The hollow shaft having a through-hole at a central position, an injection rod having an injection plunger attached unitarily to a tip of said injection rod is inserted into said through-hole. The injection plunger is freely slidable in a central portion of the agitating member and extendable beyond the tip of the agitating member so as to insert into said weighing chamber freely.

The Bradley reference shows a method and apparatus for molding a metal alloy where the alloy is maintained in a thixotropic, semi-solid, state in a reciprocating extruder at temperatures above its solidus temperature and below its liquidus

temperature. The thixotropic slurry is injected into the mold. The material to be injected is held either between the vanes of the screw or in an accumulation chamber (C).

The Kono ('976) reference shows an melted metal die casting method that uses a pair of elongated chambers, one for heating the metal and the other for injecting the metal. The heating chamber is elevated, while the injecting chamber is horizontal.

The Kono ('372) reference shows a thixotropic (semi-solid) process where metal alloy is made liquid in a feeder, cooled to the thixotropic state in an inclined barrel, held at a thixotropic state in a horizontal accumulation chamber, and injected through an exit port by a horizontal injection barrel

The Bradley and Kono references do not make the invention obvious because it is not logical to combine the references and because combined they do not show the invention.

It is not logical to combine the references because they deal with metal in different states - thixotropic for Bradley and Kono ('372) and liquid for Kono ('976). These states require different handling because the viscosity of thixotropic metals is significantly higher than liquid metals. As explained in the background section, liquids do not exhibit the same viscosity as slurries and so cannot reliably build pressures as the slurries in

the above references. Further Kono '976 critiques thixotropic processes as producing parts that require further finishing.

Even if it were logical to combine the references, the references do not show the invention because the Bradley reference does not show injection mechanisms for liquid metal but rather for thixotropic, that is semi-solid, metal. Therefore, it is not obvious that the process shown in Bradley would work for liquid metal. None of the references show the use of a single inclined mechanism that receives material from a feeder, holds molten metal, and accommodates a plunger in the inclined chamber. Bradley uses a horizontal chamber, while both Kono references parse these functions between two chambers, only one of which is inclined. Indeed, in Col 1, lines 51-56, Kono ('976) criticizes the use of a single chamber as making it difficult to accurately control all the parameters.

The Examiner is encouraged to telephone the undersigned attorney to discuss any matter that would expedite allowance of the present application.

Respectfully submitted,

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MARKED-UP VERSION OF SPECIFICATION PARAGRAPHS

Paragraph Extending From Page 6, line 22 to Page 7, line 5.

In the drawings, a reference numeral 1 is an injection mechanism and a reference numeral 2 is a mold-clamping mechanism, are both arranged on an upper surface of a base 3. A reference numeral 4 is a pedestal 4 which is arranged so as to rotate or, advance or retreat freely to the mold-clamping mechanism 2, and a frame 5 constituted by a pair of plate bodies ~~51 and 51~~ 1a which the upper surface is oblique is provided on the rear portion so as to swivel freely, and the described-above injection mechanism 1 is provided obliquely on the frame 5 in a manner that a nozzle side is directed in a downward direction to the mold-clamping mechanism 2.

Paragraph Extending from Page 7, line 6 to line 17.

The described-above injection mechanism 1 is constituted by a melting cylinder 11, agitating and injection means in the inside, which will be described hereinafter, an injection cylinder 12 provided spacing an interval on the rear-end side of the melting cylinder 11, an electric motor 14 for agitating attached to a bifurcated-shape supporting leg 13 arranged an under side of a rear end of the melting cylinder 11, and a [illegible] device 15

applying the powdered low-melting point metallic material consisting of nonferrous metals into the melting cylinder. The [illegible] device 15 is constituted by a horizontal cylinder 15a and a screw shaft 15c in the inside thereof which is rotated by an electric motor 15b provided the end of the cylinder. Although being omitted in the drawings, it is constituted by a structure capable of attaching a heater for preheating the material to a surrounding of the cylinder as required.

Paragraph Extending from Page 8, line 6 to line 12.

A supply port 19 is arranged on an upper side of an intermediate portion of such melting cylinder, and the described-above [illegible] device 15 for the metallic material is connected to the supply port 19 through a pipe passage 20. Moreover, a rear end of the melting cylinder 11 is in the opened condition, and an agitating member 21 and an injection member 22 for the molten metal constituting the described-above agitating and injection means are arranged in the inside from the rear end to the inside.

Paragraph Extending from Page 9, line 13 to line 22.

The described-above agitating member 21 is constituted by a revolution shaft that agitating wings 24 [illegible] with a plurality

of stripes are formed intermittently so as to swivel freely on an outer periphery of a tip portion of a hollow shaft portion 23 having a through-hole at the central position as shown in Fig. 4. These agitating wings 24 [illegible] have an external diameter approximately equal to an inner diameter of the melting cylinder 11. Moreover, a flange 25 for a partition which a sealing ring closed proximity to an inner peripheral surface of the melting cylinder 11 is fitted to a the outer periphery is formed unitarily on a periphery of the shaft portion in the rear than the agitating wing 24 of the hollow shaft portion 23.

Paragraph Extending from Page 8, line 23 to Page 9, line 3.

Moreover, a pulley 26 is fixed on the end of the described-above hollow shaft portion 23 projecting from an opening end of the melting cylinder 11, and a timing belt 28 is looped over this pulley 26 and a pulley 27 of a driving shaft end of the described-above electric motor 14, and the agitating member 21 is revolved by the electric motor 14 in the melting cylinder, and the molten metal can be agitated by the described-above agitating wings 24 [illegible] 24.

Paragraph extending from Page 9, lines 4 - 11.

The described-above injection member 22 is constituted by an injection rod 29 inserted into a through-hole of the

described-above hollow shaft portion 23 and to be provided slidable freely on a central position of the agitating member 21 and an injection plunger 30 attached to the tip [illegible] to fit to the described-above weighing chamber 17 from the front surface of the agitating member 21 , and a screw 29a shutting off a molten metal intruded into a clearance between the hollow shaft portion 23 on intermediate region of the injection rod 29 is formed.

Paragraph Extending from Page 11, line 7 to line 14.

Such injection cylinder 12 and described above melting cylinder 11 are the ends of the described-above supporting legs 13 and 34 projected to both sides of the respective under side and arranged are inserted into support shafts 40 [illegible] arranged side by side on both sides of an oblique-upper surface of the described-above frame 5, and are attached in a manner that the nozzle member 10 is placed on the lower side and is directed in a downward direction, thereby the described-above injection mechanism 1 installed obliquely to the described-above mold-clamping mechanism 2 to be constituted.

Paragraph Extending from Page 12, line 1 to line 10.

In the frame 5 constituted by the described-above pair of plate bodies [illegible], a support shaft 41 is attached to the

inside of a plate body which an upper surface is formed on an surface inclined in an inward direction with an angle of approximately 45° with members 41 ~~41~~ at both sides. This frame 5 is placed and arranged on a gate-type receiving seat 6 arranged on the rear end of the described-above pedestal 4 so as to swivel freely (not shown), and the nozzle touch device 48 of the nozzle member 47 provided horizontally on the front surface of the nozzle touch block 45 with member 52 across from a central position of the inside of the receiving seat 6 to the described-above nozzle touch block 45 is arranged.

Paragraph extending from Page 12, lines 14 - 22.

A hydraulic cylinder 49 of this nozzle touch device 48 is fixed to a receiving member 50 of a central position within the pedestal ~~4~~ 4 installed on the base 3, moreover, a rod member 51 coupled with a piston rod (not shown) in the inside the tip is coupled with the described-above nozzle touch block 45, and the pedestal 4 is moved in the advancing and/or retreating directions together with the injection mechanism 1 of the upper surface of the frame 5 by a movement of the advancing and/or retreating directions of the rod member 51, whereby a touch of the nozzle can be performed to a molding 7 of the described-above nozzle member.

Paragraph Extending from Page 12, line 23 to Page 13, line 7.

The upper of the inside of the described-above nozzle touch block 45 is formed on an inclined rear surface positioning at the right angle to the nozzle member 10 of the described-above injection mechanism 1, and a gate for nozzle-touching is opened and arranged on inclined rear surface. Moreover, a hot runner 53 communicating the described-above nozzle member 47 with the nozzle member 10 of the injection mechanism 2 is bent and formed on the inside of the nozzle touch block, whereby nozzle-touching can be performed without a clearance and a leakage of the molten metal at injection and filling can be prevented, event though the injection mechanism 1 is installed obliquely on the mold-clamping mechanism 4.

Paragraph Extending from Page 13, line 20 to Page 14, line 6.

First, the inside is raised to the high temperature than the melting point by heating the melting cylinder 11 by the band heater 16 of the outer periphery to temperature of approximately 620° to 680°. Next, the hollow shaft portion 23 is made an agitated condition by revolving using the described-above electric motor 14 with at a set speed. When applying the powdered metallic material into the melting cylinder 11 from the supply port 19 with the described-above [illegible] device 18 in such condition, the

metallic material is fallen into the melt of the molten metal stored in the region of the agitating wings 24 ~~and 24~~ being revolving together with the hollow shaft portion 23 immediately since the melting cylinder 11 is inclined in a downward direction, whereby it melts due to hear stored in the molten metal, as well as is mixed into the melt by the agitating wings 24 ~~and 24~~. Therefore, it melts in an extremely short time.

Paragraph Extending from Page 15, line 19 to Page 16, line 4.

Agitation of the molten metal by revolution of the described-above agitating wings 24 ~~and 24~~ can be performed continuously, since the agitating member 21 and the injection member 22 are constituted separately, also during such injecting and filling from weighing. According to this operation, melting and keeping warm for the molten metal can be stabilized. Melting of the metallic material is performed by heating from the outside source, and the agitating member 21 has only to prevent nonuniformity in temperature of the metallic material in the melting cylinder molten by heating by revolution, and injecting and weighing is performed by the agitating member 21 in the central portion, whereby the melting efficiency of the metallic material can be performed.

MARKED-UP VERSION OF ABSTRACT

[illegible]

[illegible]

MARKED-UP VERSION OF CLAIM AMENDMENTS

~~CLAIM~~ 1. An injection molding machine for low-melting point metallic material in which the injection molding machine is constituted by:

~~a melting cylinder, a tip portion, a melting cylinder, and a feed chip portion;~~

~~said tip portion~~ having a weighing chamber with a required length communicating with a nozzle member ~~at a first end and with said melting cylinder at a second end; within a tip portion~~

~~said melting cylinder~~ having a supply port on an upper side ~~of an intermediate portion,~~ and an agitating and injection means disposed within, ~~said melting cylinder~~ provided obliquely in a manner that a tip portion will be inclined in a downward direction, ~~and~~ a feed chip ~~material in said melting cylinder is supplied from said supply port and is heated in the tip portion and simultaneously plasticized in the weighing chamber, said agitating and injection means~~ capable ~~of~~ to rotate or, advance or retreat freely;

~~a feed chip material with the feed chip material in the melting cylinder, and~~ a device driving those means; ~~wherein the feed chip material is supplied from the supply port, and the feed chip material is heated and plasticized in the tip portion by the agitating and injection means~~

wherein said agitating and injection means is constituted by an agitating member in which a plurality of agitating wings having a plurality of ~~slits~~ are formed intermittently about an outer periphery of a tip portion of a hollow shaft that extends a length of said melting cylinder, with an external diameter approximately equal to an inner diameter of the melting cylinder, ~~a tip portion of which is formed~~ having a through-hole at a central position and an injection ~~means~~ plunger attached unitarily to a tip of an injection rod inserted into said through-hole, said injection plunger ~~being provided~~ slidably in a central portion of the agitating member and ~~a tip portion~~ the tip of the agitating member so as to insert into said weighing chamber freely.

CLAIM 2. The injection molding machine for low-melting point metallic material according to Claim 1, wherein said injection rod

has a screw shutting off a molten metal [illegible] into a clearance between [illegible] a hollow shaft portion on an intermediate region [illegible].

CLAIM 3. The injection molding machine for low-melting point metallic material according to claim 1, wherein said injection plunger is provided with a high-temperature resistant sealing ring on an outer periphery of [illegible] tip portion [illegible] said injection plunger and has a flowing port through [illegible] the [illegible] tip of a conical plunger [illegible] inside [illegible] a fitting [illegible] sealing ring.

CLAIM 4. The injection molding machine for low-melting point metallic material according to claim 1, [illegible]:

[illegible];

[illegible];

[illegible];

[illegible] a hydraulic cylinder [illegible]

[illegible] a required interval [illegible] of said melting cylinder, [illegible] hydraulic cylinder [illegible] [illegible]

[illegible] hydraulic cylinder [illegible] ~~frame by inserting~~ said supporting legs inserted respectively in said support shafts ~~which [illegible] and [illegible] [illegible]~~ [illegible] wherein a nozzle touch device is formed when said injection rod is unitarily coupled by a [illegible] across said interval to said hydraulic [illegible] ~~[illegible] of said [illegible]~~.

Claim 5. The injection molding machine for low-melting point metallic material according to claim 1, wherein a driving device for said agitating member is constituted by an electric motor, which is provided on sides of supporting legs of the melting cylinder so as to move together with said melting cylinder.

CLAIM 6. The injection molding machine for low-melting point metallic material according to claim 4, [illegible]:

[illegible]

a nozzle touch block [illegible] on the [illegible] tip of said nozzle touch device, [illegible] placed on said pedestal [illegible] so as to swivel freely [illegible] touching a nozzle member attached to the front of the nozzle touch block to moldings [illegible] by moving the pedestal [illegible] to the mold-clamping mechanism [illegible] across the nozzle [illegible] block and a rear of an upper surface of the base.

CLAIM 7. The injection molding machine for low-melting point metallic material according to claim [illegible], wherein said nozzle touch block [illegible]

an upper inner side;

a gate for nozzle-touching on said inclined rear surface with the nozzle member of said injection mechanism;

a hot runner bent formed within the block